

Remarks

Applicants believe that this amendment places the subject application in better condition for allowance and in so doing introduces no new issues. Therefore, entry of this Amendment, reconsideration of the application, and allowance of all claims pending herein is respectfully requested.

The Office Action addresses claims 1-18. Claims 19 and 20 are new. Support for new claims 19 and 20 may be found in the specification at paragraphs 0019, 0111. Claims 1-20 are currently pending.

Applicants have procured an English language translation of the text of the Mikio reference. The English language translation is being submitted with this response.

The Examiner's concerns are addressed separately below in the order raised in the outstanding Office Action. No new matter has been added.

Rejections under 35 U.S.C. § 103:

Claims 1-18 stand rejected under § 103 as unpatentable over Mikio, JP 2000-020501, in view of Nickel et al., U.S. App. No. 2003/0005068, and Official Notice. This rejection is respectfully traversed.

*1. No prima facie case of obviousness has been made*

According to the MPEP, in order for a prima facie case of obviousness to be made, Office personnel must articulate the following.

- (1) a finding that the prior art included each element claimed, ... [and]
- (2) a finding that ... in combination, each element merely performs the same function as it does separately.

MPEP § 2143. As discussed below, the cited art do not disclose all of the claimed elements. Also, the cited art do not disclose the claimed elements performing the same functions.

Moreover, there is no apparent reason to combine the various cited references/Official Notice. A proposed combination of references is not obvious unless there is an "apparent reason" to combine the references. *In re Whalen*, Appeal 2007-4423 (BPAI 2008) (precedential opinion). For example, as discussed below, Nickel discloses a master/slave relationship among

its computers, for parallel computing to solve a computationally complex problem. This is a different approach from the claimed decentralized, peer to peer data swap among partner computers. There would therefore be no apparent reason to apply the Nickel disclosure to the claimed partner computer data exchange for cross-correlation of data.

2. *The proposed combination would not result in the exchange of each piece of data only once.*

New claim 19 recites "wherein each partial data unit is exchanged only once." Support for this claim may be found in the specification at Figs. 3 and 4. Only certain sub-units of data need to be exchanged at each exchange step. In contrast, Mikio teaches exchanging each array at every exchange step, which, as discussed below, results in Mikio data volume being doubled at each step. Therefore, claim 19 has not been rendered obvious by the cited art.

3. *The proposed combination would not result in a constant volume of data exchange.*

New claim 20 recites "wherein in each data exchange, the volume of the data exchanged remains constant." In contrast, in Mikio the volume of traffic exchanged per cycle doubles with each transfer. Mikio states the following.

[0034]

As a first step, data is exchanged with the arithmetic processing unit having an identification number obtained by reversing a numeral on the  $2^0$  digit (1 for 0 or 0 for 1). For example, the arithmetic processing unit 0 (000) exchanges n pieces of data with the arithmetic processing unit 1 (001)... 2n pieces of elements are collected in each arithmetic processing unit.

[0035]

At a second step, data is exchanged with the arithmetic processing unit having an identification number obtained by reversing the numeral on the  $2^1$  digit. ... 2n pieces of data including data received from the arithmetic processing unit 1 in the first step is transmitted in addition to the calculation result of the arithmetic processing unit 0. As a result, 4n pieces of elements are collected in each of the arithmetic processing units.

[0036]

Lastly, as a third step, data is exchanged with the arithmetic processing unit having an identification number obtained by reversing a numeral on the  $2^2$  digit. For example, the arithmetic processing unit 0 (000) exchanges 4n pieces of

data with the arithmetic processing unit 4 (100), and the arithmetic processing unit 3 (011) with the arithmetic processing unit 7 (111). 8n pieces of elements are collected in each arithmetic processing unit, and the operation is completed.

(Mikio ¶ 0034-36) (emphasis added).

In contrast, in the claimed invention, the volume of traffic exchanged in each step remains constant, and each piece of data is transferred only once. Therefore, the total volume of traffic at the end of the process is much larger for Mikio than for the claimed invention. Since the claimed volume of traffic remains constant, more data may be processed with the claimed system. Therefore, claim 20 has not been rendered obvious by the cited art.

4. *The proposed combination would not include partner computer data exchange, with no more than one partner computer remaining idle.*

The independent claims (claims 1,3,4,7, and 11-14) recite "wherein each computer PC<sub>i</sub> of said plurality n is configured for a first exchange of a partial data unit with a partner computer chosen from said plurality n of computers, so that no more than one computer PC<sub>i</sub> is idle during said first exchange." The Office Action states that "Mikio fails to explicitly disclose wherein [no] more than one computer is idle during either the first or additional exchange steps. However, Nickel discloses a distributed computing wherein all partner computers/node engage in non-idle activity during their assignment to a computing cluster ([0042])." (Office Action p. 5).

Applicants respectfully submit that before reaching the question of whether or not Nickel's computers are idle, one must address the predicate question of whether or not Nickel discloses data exchange between partner computers (e.g., peer to peer data exchange) as claimed. Nickel does not disclose a data exchange between pairs of partner computers. Instead, Nickel discloses a master computer, which controls other slave computers. Nickel states: "[t]he present invention is a supercomputer comprising a single dedicated computer (called the master computer) that coordinates and controls all the other participating computers." (Nickel ¶ 0016).

Nickel makes no disclosure or suggestion of data exchanges between pairs of partner computers. Instead, the master computer distributes, among the slave computers, portions of a computationally intense problem to be solved. Nickel states: "[t]he present invention is a

supercomputer comprising a single dedicated computer (called the master computer) that coordinates and controls all the other participating computers." (Nickel ¶ 0016).

The Nickel master computer allocates parts of the problem to the slave computers, as follows.

The method comprising the steps of: (a) building a parallel virtual machine comprising a master computer and at least one slave computer...; (b) dividing the computationally intensive problem into a plurality of task quantum; (c) assigning to the at least one slave computer at least one task quanta selected from the plurality of task quantum; (d) completing on the at least one slave computer the at least one task quanta; (e) receiving on the master computer a result provided by the at least one slave computer; and repeating steps (c), (d) and (e) until the computationally intensive task is completed.

(Nickel ¶ 0009). Nickel does not disclose any data exchange (e.g., peer to peer) among the slave computers.

It is also noted that the claims at issue recite a predetermined number “n” of computers, which number remains constant during the data exchange process, and that of these n computers, no more than one is idle at any time. See, e.g., claim 1, which states that “each computer PC<sub>i</sub> of said plurality n is configured for a first exchange of a partial data unit with a partner computer chosen from said plurality n of computers” and “n being a real number which is equal to or greater than 2.” Nickel does not disclose a predetermined numberset plurality of computers to be used throughout the data exchange process. Each of the independent claims recites “a plurality n of computers PC<sub>i</sub>, n being a real number which is equal to or greater than 2, and i being an integer from 0 to n-1.”

Instead, Nickel discloses that computers may be added to or removed from the cluster during the problem solving operation, at which point the master computer reapports the problem among the active slave computers. Nickel discloses that “[p]articipating computers can be removed from the supercomputer while computations are in process,” and that “[p]articipating computers can be added to the supercomputer while computations are in progress and they will be exploited by the in-progress computation.” (Nickel ¶¶ 0021, 0022). Random addition and removal of computers thus fail to satisfy the claim recitation of a predetermined (fixed) number “n” of computers.

And, it should be recognized that if computers were not removed while computations were in progress, then Nickel would also fail to satisfy the claimed recitation that “no more than one computer PCi is idle during said... exchange.” Therefore, a prima facie case of obviousness has not been made.

5. *The proposed combination would not include full duplex communications*

Claim 3 recites: "wherein said plurality n of computers PCi are communicably coupled via a connector configured for full duplex transmission and configured for a switching function." The Office Action states "Mikio fails to explicitly disclose that the network medium allows for full duplex communications. However, the Examiner takes Official Notice that full duplex network communication among computing entities was commonplace well prior to the time of the claimed invention, and, as such, was an obvious feature for the parallel computing system disclosed in Mikio." (Office Action p.5). As discussed above, Nickel discloses a central master computer which controls slave computers. Mikio discloses a host computer disseminating data to the processing units, with the processing units only exchanging data if needed.

[T]he input data read by the host's computer is transmitted to all the processing units through the means of communication 4. Calculation of the processing unit 2-1, 2-2, --, the field respectively assigned in 2-8 is performed, and data is delivered and received by communication between processing units if needed.

(Mikio ¶ 0037). Since the cited art disclose a central master or host computer which disseminates data to slave / peripheral computers, there would be no apparent reason to add full duplex communications to the Mikio or Nickel disclosures. As discussed above, a proposed combination of references is not obvious unless there is an "apparent reason" to combine the references. *In re Whalen*, Appeal 2007-4423 (BPAI 2008). Therefore, claim 3 has not been rendered obviousness by the cited art.

6. *The cited art do not disclose the characteristics of claims 2 and 6.*

Claims 2 and 6 refer to the number of partial data units which are exchanged. The Office Action appears to conflate the number of data units with the number of data exchange steps, as follows.

For claim 2, the combination of Mikio, Nickel and Official Notice discloses the data distribution method according to claim 1 wherein said step is repeated n-1

times if  $n$  is even and  $n$  times when ...  $n$  is odd, and each cycle of the step is repeated only between said pair of computers and a same pair of computers is allocated without overlapping through all of the steps (Mikio, [0059]).... For claim 6, the combination of Mikio, Nickel and Official Notice discloses the data distribution method according to claim 4 or 5 wherein said steps are applied to every block  $n-1$  times if  $n$  is an even number, and  $n$  times if  $n$  is an odd number and each cycle of the step are repeated between the said pairs of computers assigned without overlapping (Mikio, [0022] and [0059]).

(Office Action p.5-6). Claims 2 and 6 refer to  $n$  or  $n-1$  partial data units, not steps. Claim 2 recites "wherein each computer  $PC_i$  of said plurality  $n$  is configured to exchange with a partner computer  $n-1$  partial data units when  $n$  is even, and  $n$  partial data units when  $n$  is odd." Claim 6 recites "wherein each computer  $PC_i$  of said plurality  $n$  is configured for partner exchange of  $n-1$  partial data units . . . when  $n$  is an even number;" and "wherein each computer  $PC_i$  of said plurality  $n$  is configured for partner exchange of  $n$  partial data units with a partner computer . . . when  $n$  is an odd number." Applicants have found no disclosure of the exchange of the claimed number of partial data units, per exchange step, in the cited art.

Applicants also respectfully submit that the MPEP makes clear that Official Notice is not always appropriate.

Official notice without documentary evidence to support an examiner's conclusion is permissible only in some circumstances. ... It would not be appropriate for the examiner to take official notice of facts without citing a prior art reference where the facts asserted to be well known are not capable of instant and unquestionable demonstration as being well-known. For example, assertions of technical facts in the areas of esoteric technology or specific knowledge of the prior art must always be supported by citation to some reference work recognized as standard in the pertinent art.

MPEP § 2144.03(A). The Office Action does not cite a reference for a more efficient data exchange as claimed. The MPEP also requires that the basis for an Official Notice to be set forth explicitly.

If such [common knowledge] notice is taken, the basis for such reasoning must be set forth explicitly. The examiner must provide specific factual findings predicated on sound technical and scientific reasoning to support his or her conclusion of common knowledge. ... The applicant should be presented with the explicit basis on which the examiner regards the matter as subject to official notice so as to adequately traverse the rejection in the next reply after the Office

action in which the common knowledge statement was made.

MPEP § 2144.03(B). Without a more explicit explanation, it is not clear how Official Notice could be taken of a data exchange among  $n$  computers, which may be completed with only  $n$  or  $n-1$  data exchange steps. Therefore, a prima facie case of obviousness has not been made.

7. *The proposed combination would not enable efficient cross-correlation of data*

Each of the independent claims recites a computer configured for the cross-correlation of partial data units. Independent claims 1, 3, 4, 7, 11–14 recite "a computer PC<sub>k</sub>, wherein computer PC<sub>k</sub> is configured for cross-correlation processing of partial data...."

The Office Action states that "[f]or claim 10, the combination of Mikio, Nickel and Official Notice discloses the data distribution method according to one of the claims 1 to 9 that data used in this method are time series data recorded from radio telescopes (Mikio, [0001], parallel computing by its very nature is concerned with handling complex problems involving enormous amounts of data)." (Office Action p. 7). However, cross-correlation of signal data is not the same as any computationally intense problem to be solved by a cluster computing. Applicants respectfully submit that a more detailed explanation of Official Notice is necessary to show that the computationally intensive problems described in the Nickel and Mikio disclosures are identical to the claimed cross-correlation of data. Therefore, a prima facie case of obviousness has not been made.

8. *The claimed invention operates with an odd number of computers*

Claim 17 recites the use of  $n$  computers, "wherein  $n = 2^k + 1$ , wherein  $k$  is an integer greater than 0," and claim 18 recites "wherein  $n = 2^k - 1$ , wherein  $k$  is an integer greater than 0." The Office Action states "[f]or claim 17, the combination of Mikio, Nickel and Official Notice discloses the system of claim 1, wherein  $n = 2^k + 1$ , wherein  $k$  is an integer greater than 0 (Mikio, [0021], disclosure of computing node addressing comprising  $[0-2n-1]$ ), (sic)" and "[f]or claim 18 the combination of Mikio, Nickel and Official Notice discloses the system of claim 1, wherein  $n = 2^k - 1$ , wherein  $k$  is an integer greater than 0 (Mikio, [0021], disclosure of computing node addressing comprising  $[0-2n-1]$ ) (sic)."

Applicants respectfully submit that, as discussed in detail in a previous response, Mikio is only configured for data exchanges among  $2^k$  computers, and adds or removes computers so

that only  $2^k$  computers are used at one time. Therefore, Mikio fails to disclose the claimed use of  $2^{k+1}$  computers. Also, as discussed above, Applicants believe that Official Notice does not provide guidance as to how the Mikio system could use computers in an amount other than  $2^k$ . Therefore, claims 17 and 18 are not rendered obviousness by the cited art.

9. *The cited art do not disclose dividing data units into sub-units*

Each of the independent claims recites dividing individual data units into sub-units. Claims 1, 3, 11, 13, and 14 recite "data  $X_i$  being divisible into  $n$  partial data units  $X_{i(j)}$ ... [and] data  $X_i$  being divisible into  $n$  partial data units  $X_{i(k)}$ ." Claims 4, 7, and 12 similarly recite "data  $X_i$  being divisible into  $n$  partial data units  $X_{i(m)}$ ... and data  $X_i$  being divisible into  $n$  partial data units  $X_{i(k)}$ ."

The claimed computers are also configured for exchanges of partial data units. Claim 1 recites "wherein each computer  $PC_i$  ... is configured for a first exchange of a partial data unit ... and wherein each computer  $PC_i$  of said plurality  $n$  is configured for an additional exchange of additional partial data units." Claim 3 recites "wherein each computer  $PC_i$  of said plurality  $n$  is configured for partner exchange of  $n-1$  partial data units with a partner computer." Claim 4, 7, and 11-14 recite "wherein each computer  $PC_i$  of said plurality  $n$  is configured for partner exchange of a partial data unit."

The Office Action found that Mikio discloses dividing an array of data units into partial data sub-units, and that Mikio also discloses the exchange of the partial data units among computers, citing Mikio ¶ 0022 and ¶ 0059.

For claims 1, 3, 4, 7, and 11-14, Mikio discloses a system for the cross-correlation of data, comprising: ...

data  $x_i$  being divisible into  $n$  partial data units  $X_{i(i)}$  ... data  $x_i$  being divisible into  $n$  partial data units  $X_{i(k)}$  ... ([0022], lines 6-15, disclosure of division of data sets for distribution to cluster nodes);

\* \* \*

wherein each computer  $PC_i$  of said plurality is configured ... for a first exchange of a partial data unit.... ([0059], disclosure of nodes of parallel system operating in pairs to exchange data for processing); and

wherein each computer  $PC_i$  of said plurality  $n$  is configured for an



additional exchange of additional partial data units....

(Office Action p. 3).

Applicant respectfully submits that Mikio does not disclose division of data units, or the exchange of divided partial data units. Mikio discloses dividing arrays of data elements into smaller arrays. However, Mikio does not disclose subdividing individual data units into sub-units. Mikio states "data arrays which were divided into  $(2^m + k)$  pieces of small arrays and distributed to / calculated and processed at the  $(2^m + k)$  units of the arithmetic processing units are to be collected in a single array again." (Mikio ¶ 0022). Mikio refers to "data arrays which were divided into  $2^n$  pieces of small arrays and distributed to the  $2^n$  units of the arithmetic processing units." (Mikio ¶ 0021). Mikio further explains "[t]he array A made up of  $8 \times n$  pieces of data is divided into eight pieces of small arrays  $a_1, a_2, \dots, a_8$  made up of  $n$  pieces of data and assigned to 8 arithmetic processing units 2-1, 2-2, ..., 2-8." (Mikio ¶ 0033).

An array is by definition a collection of data items. Array is defined as "[a] collection of data items with each identified by a subscript or key and arranged in such a way that a computer can examine the collection and retrieve data from these items...." MCGRAW-HILL DICTIONARY OF SCIENTIFIC AND TECHNICAL TERMS, 5<sup>th</sup> Ed. p.130. Mikio discloses dividing an array into smaller arrays, not dividing the items within those arrays.

Dividing an array into small arrays is not the same as dividing a data item. A data item is defined as "[a] single member of a data element." MCGRAW-HILL DICTIONARY OF SCIENTIFIC AND TECHNICAL TERMS, 5<sup>th</sup> Ed. p.519. Therefore, Mikio does not disclose the claimed subdivision of data units into sub-units. Therefore, a prima facie case of obviousness has not been made.

10. *The proposed combination would change the principle operation of the cited art*

In addition, the proposed combination would change the principle of operation of the cited art. "If the proposed ... combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims prima facie obvious." MPEP § 2143.01(V). As discussed above, Nickel discloses a master computer that distributes data to slave computers. To create the claimed invention, the Nickel principle of operation would have to be changed to that of

decentralized data exchanges between pairs of partner computers. Therefore, a prima facie case of obviousness has not been made.

*11. The cited references are not analogous art.*

In addition, in order to rely on a reference in an obviousness rejection, the reference must be analogous art to the claimed invention. MPEP § 2141.01(a)(I). The Office Action states that "Mikio and Nickel are analogous art because both are from the endeavor of distributed computing comprising networked PCs." (Office Action p.5). Applicants respectfully submit that Mikio and Nickel are not analogous to Applicants' invention. Differences in structure and function should be considered in determining what art should be considered analogous. MPEP § 2141.01(a)(II). As discussed above, Nickel and Mikio both have different structures and functions than the claimed invention. Therefore, the cited art is not analogous to the claimed invention.

Therefore, the claims are not rendered obvious by the cited art.

### CONCLUSION

For at least any one of the foregoing alternate reasons, Applicants submit that the dependent claims are allowable for the same reasons as the independent claims from which they directly or ultimately depend, as well as for their additional limitations. Applicants therefore further submit that all of the stated grounds of objection and rejection have been properly traversed, accommodated, or rendered moot.

This application is now believed to be in condition for allowance, and such action at an early date is respectfully requested. However, if any matters remain unresolved, the Examiner is encouraged to contact the undersigned by telephone.

In the unlikely event that the transmittal letter is separated from this document and the Patent Office determines that an extension and/or other relief is required, Applicants petition for any required relief including extensions of time and authorizes the Assistant Commissioner to charge the cost of such petitions and/or other fees due in connection with the filing of this document to **Deposit Account No. 50-0734** referencing Docket No. 1215.004. However, the

Assistant Commissioner is not authorized to charge the cost of the issue fee to the Deposit Account.

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'RS', followed by a horizontal line.

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